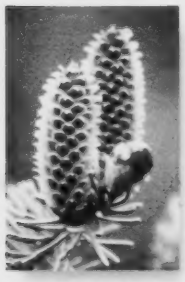
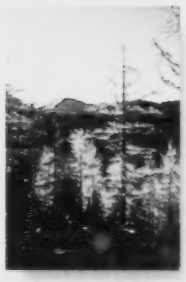
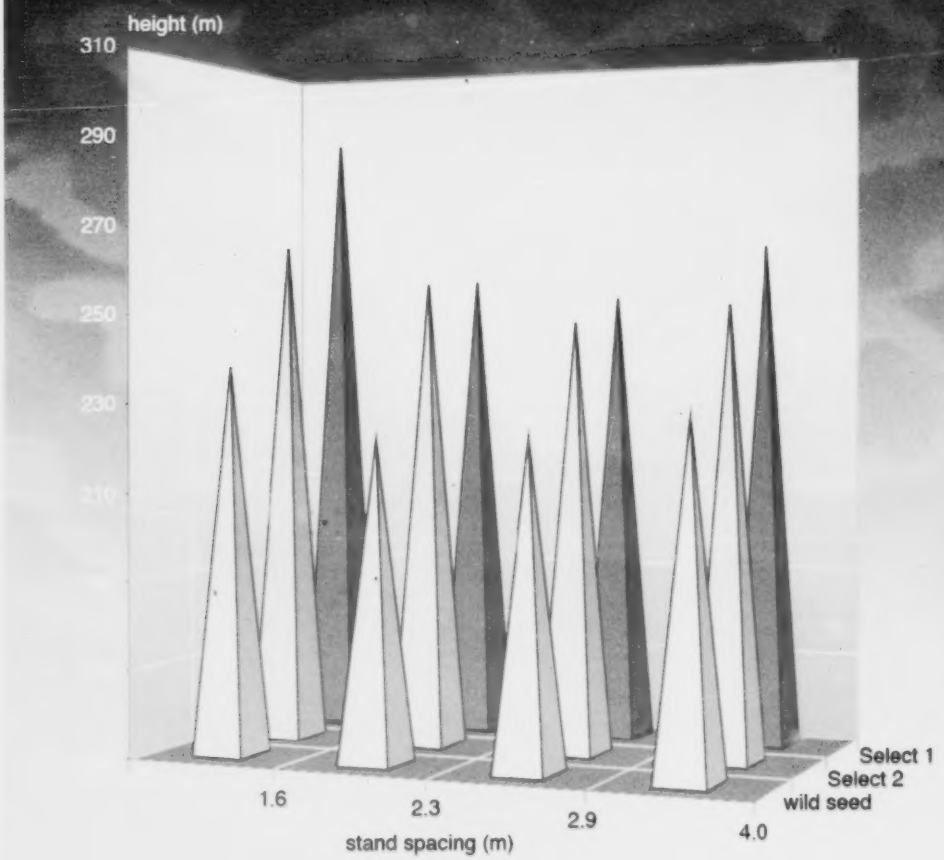




FGC Forest Genetics Council of British Columbia

ANNUAL REPORT 2003/2004



DOC
BC
F67
B
2003/04
c.3

Canadian Cataloguing in Publication Data

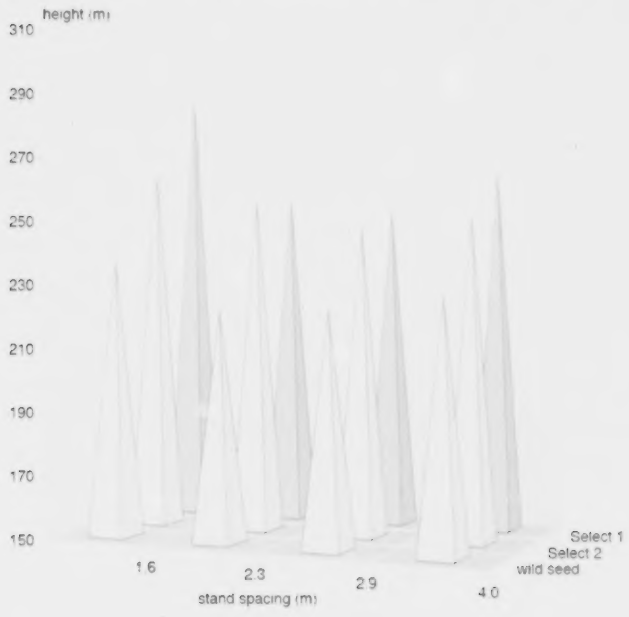
Forest Genetics Council of British Columbia
Annual report. -- 2000/2001

Annual.
Title from cover
Issuing body varies.
ISSN 1499-125X = Annual report – Forest Genetics Council of British Columbia

1. Forest Genetics Council of British Columbia – Periodicals.
2. Trees –
SD399.5.B74 634.9'8'09711'05 C2001-960195-6

Cover Figure

Graphic of age 7 height across 5 coastal test sites for a Douglas-fir realized-gain trial series. Three levels of genetic selection are being tested, including Wild stand, a mix of the best 10 families available at the time of sowing (Select 1), and a mix of 10 families rated as having a mid-level of gain between wild stand and Select 1 (Select 2). Tests were established at 4 stand densities in 144-tree (12 x 12 tree) replicated block plots. Selected families are performing as predicted based on progeny test breeding value estimates.



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Acknowledgements

This Annual Report presents the 2003/04 achievements of the many people involved with tree improvement and forest genetics in British Columbia.

FGC Co-Chairs Shane Browne-Clayton and Dale Draper are thanked for their guidance throughout the year.

Technical Advisory Committee Chairs provided important guidance to all subprograms, and are acknowledged for their efforts. They are Sally Aitken (Coastal TAC), Mike Carlson (Interior TAC), Dale Draper (Gene Conservation TAC), Chris Hawkins (Extension TAC), Robb Bennett (Orchard Pest Management TAC), and Leslie McAuley (Gene Resource Information Management Advisory Committee).

All members of the Forest Genetics Council and Technical Advisory Committees are thanked for their careful deliberations, contributions, and support. They are listed on the back page of this Annual Report.

My appreciation also goes to Roger Painter (FIA Tree Improvement Program Administrator) for his ongoing efforts, commitment, and cooperation.

Finally, the support and guidance of Larry Pedersen (provincial Chief Forester) and Ken Baker (Deputy Chief Forester) are instrumental in keeping this program on track. My thanks for their important contributions.

JACK H. WOODS
PROGRAM MANAGER
FOREST GENETICS COUNCIL
OF BRITISH COLUMBIA

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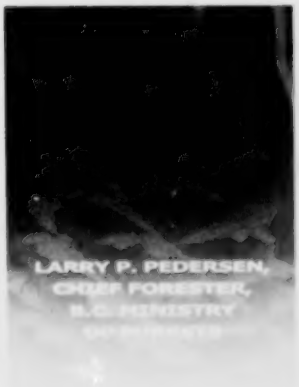
Message from the Chief Forester



I am pleased to participate in the fourth Annual Report of the Forest Genetics Council of BC (FGC).

The 2003/04 fiscal year was the second for the Forest Investment Account (FIA) Tree Improvement Program. Notably, the business practices guided by the FGC continue to provide the structure and means to effectively deliver this important provincial program. These same business practices have also generated considerable support for tree improvement and given FIA decision-makers confidence in Council's ability to produce results.

A great deal of work is represented in this Annual Report, and I recognize not only Council, but also members of the Technical Advisory Committees that support Council's work. Their efforts to provide effective and detailed planning and coordination are critical to the success of the program.

The key strategic objectives set by Council have once again been exceeded at the provincial level. This accomplishment is considerable given the uncertainty associated with estimating seed orchard production rates, seedling orders, and gain estimates province-wide. Other objectives associated with gene conservation and monitoring progress are also being fulfilled. Again, I applaud members of Council and all affiliated Technical Advisory Committees for their efforts and achievements.

Crown land forest management will significantly change in British Columbia with the implementation of the Forest and Range Practices Act. *Gene resource management policy will be set out in the* Chief Forester's Standards for Seed Use. *These standards simplify and consolidate current seed practices under a single guiding document. My thanks to the Industry/Ministry task team that assisted with this policy work and particular thanks to Brian Barber of Tree Improvement Branch for steering the process.*

As a direct result of this broad consultation process, these Standards will reduce complexity and provide for reasonable flexibility in seed use. The transition to the new Standards should be seamless for most licensees. However, as with any complex changes, some transition issues may arise and require cooperative and effective problem resolution. I am confident that we will maintain an effective seed policy environment throughout.

Finally, I want to recognize the contribution of some individuals in the tree improvement community. First, I congratulate Mr. Keith Illingworth, who received the FGC 2004 Achievement Award for his important research with lodgepole pine. In addition, I recognize Dave Walden, Don Summers, and Terry Carter; all of whom retired from tree improvement over this past year. Their experience, enthusiasm, and collective wisdom will be greatly missed in the provincial tree improvement program.

Message from Forest Genetics Council Co-Chairs

SHANE BROWNE-CLAYTON
INDUSTRY CO-CHAIR

DALE DRAPER
MINISTRY OF FORESTS
CO-CHAIR

First and foremost we recognize and sincerely thank the many industry and government staff who contribute to the provincial gene resource management program for their cooperation and dedication over the past year. Although forestry in B.C. is changing quickly, the base of support is consistent and solid, and a well-established business planning process is in place.

During the 2003/04 fiscal year, we made substantial progress in several important areas:

- *Chief Forester's Standards for Seed Use, in support of the new Forest and Range Practices Act are nearly technically complete. The Standards consolidate existing policy, guidelines and practices, and will result in efficiencies for both industry and government stakeholders when implemented. Many members of Council and affiliated committees contributed to and improved the Standards during the past year.*
- *The FGC completed a new Strategic Plan for the period 2004 to 2008. This plan sets out objectives and organizational structure for the continued cooperative delivery of gene resource management.*
- *Council membership changes were completed, resulting in greater industry representation and the addition of a member from the Canadian Forest Service.*
- *The lodgepole pine breeding program, under the leadership of Dr. Michael Carlson of the Ministry of Forests, continues to meet the challenge of selecting parents and producing sufficient scion to allow the large new orchard development led by SelectSeed Company Ltd. to proceed. These orchards are now nearing completion, marking a substantial milestone in B.C. tree improvement programs.*
- *The Centre for Forest Gene Conservation at the University of British Columbia embarked on a project to predict native tree species range shifts under various climate-change scenarios. This work draws upon past genecology research and combines it with state-of-the-art climate-change modelling. Our ability to evaluate risk associated with various seed transfers will be improved.*

The coming year will continue to present challenges for Council. As programs mature, and industry continues to feel pressure to increase competitiveness in global commodity markets, the need to realize value from all silviculture investments will increase. At the same time, public expectations regarding stewardship of the genetic resource on public lands will require careful coordination among aspects of the program directed toward conservation and those concerned with value. We are confident that Council and affiliated committees will meet these challenges.

1.0 Forest Gene Resource Management in British Columbia

"Forest gene resource management includes the conservation, controlled use, and enhancement of genetic resources of forest tree species."

Forest gene resource management encompasses the conservation, controlled use, and enhancement of genetic resources of forest tree species, and related communication and extension activities.

Forest gene resource management is a cooperative effort. The Forest Genetics Council of British Columbia (FGC) coordinates a provincial forest gene resource management program that is implemented by stakeholders in the forest industry, Ministry of Forests (MOF), Canadian Forest Service (CFS), and universities.

In broad terms, the MOF leads tree breeding activities and private industry leads operational production of reforestation materials. The CFS, MOF Research Branch, and universities undertake research supporting tree improvement, while private institutions focus on applied research related to operational production. The University of British Columbia (UBC) leads gene conservation activities, with input from all cooperators.

During the term of this report, the provincial Forest Investment Account Tree Improvement Program (FIA - TIP) was a major funding source for forest gene resource management in British Columbia. Industry, MOF, and university cooperators also contributed substantial resources.

This Annual Report describes progress on work outlined in the FGC Business Plan for 2003/04. The Business Plan and this Annual Report focus on TIP funding, although performance indicators used at both the project and provincial levels represent the combined effort of all cooperators and resources.

The report consists of six main sections. Section 1 presents an overview of the provincial program. Section 2 describes Council and Committee activities. Section 3 reports TIP budgets and expenditures, as well as progress by performance indicators. Section 4 describes progress towards FGC provincial objectives. Section 5 highlights challenges facing Council in the year ahead. Section 6 recognizes the contributions of key individuals to forest gene resource management in British Columbia.

1.1 Forest Genetics Council of British Columbia

> *The Forest Genetics Council represents the B.C. forest industry, Ministry of Forests, Canadian Forest Service, and universities.*

The FGC is a multi-stakeholder group representing the forest industry, MOF, universities, and the Canadian Forest Service. Council's mandate is to champion forest gene resource management, to oversee strategic and business planning for a cooperative provincial forest gene resource management program, and to advise the province's Chief Forester on policies related to forest gene resource management.

The Council provides a forum for stakeholder representatives to set goals and objectives, and to oversee the development and delivery of business plans to fulfill them.[1]

As set out in the 2004 Strategic Plan, Council's goal is to:

Lead the cooperative management of tree gene resources in British Columbia consistent with scientific and conservation principles, by:

- *Increasing the average volume gain of select seed used for Crown land reforestation to 20% by the year 2020,*
- *Increasing select seed use to 75% of the provincial total sown by 2013,*
- *Supporting gene conservation research and the cataloguing of indigenous-tree genetic resources,*
- *Coordinating stakeholder activities and securing resources to meet Business Plan priorities, and*
- *Monitoring progress in all aspects of gene resource management.*

Business Planning

> *Council's Technical Advisory Committees lay the groundwork for the annual FGC Business Plan.*

The annual FGC Business Plan outlines the activities and budgets of the seven subprograms that constitute the provincial forest gene resource management program.

FGC Technical Advisory Committees (TACs) provide technical and policy information to Council and contribute to the development of annual plans and associated budgets to achieve FGC goals and objectives (Figure 1).

Each committee identifies priorities, and evaluates and ranks proposals and projects for funding through the Business Plan. Council reviews all strategies, plans, or recommendations from the TACs or other agencies for approval (or revision) before including them in the FGC Business Plan.

[1] For more information on the Forest Genetics Council, see *http://www.fgcouncil.ca*.

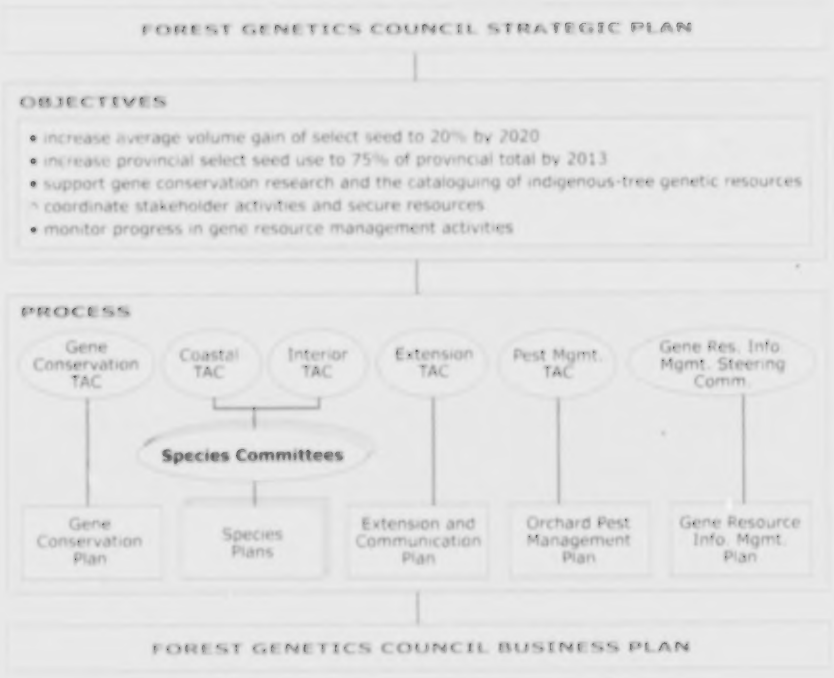

FOREST GENETICS COUNCIL STRATEGIC PLAN
OBJECTIVES
• increase average volume gain of select seed to 20% by 2020
• increase provincial select seed use to 75% of provincial total by 2013
• support gene conservation research and the cataloguing of indigenous-tree genetic resources
• coordinate stakeholder activities and secure resources
• monitor progress in gene resource management activities
PROCESS
Gene Conservation TAC
Coastal TAC
Interior TAC
Extension TAC
Pest Mgmt. TAC
Gene Res. Info Mgmt. Steering Comm.
Species Committees
Gene Conservation Plan
Species Plans
Extension and Communication Plan
Orchard Pest Management Plan
Gene Resource Info. Mgmt. Plan
FOREST GENETICS COUNCIL BUSINESS PLAN

Figure 1
The link between FGC objectives, planning processes, and the FGC Business Plan.

1.2 Forest Investment Account Tree Improvement Program

The Tree Improvement Program (TIP) is part of the provincially delivered Forest Investment Account (FIA). FIA promotes sustainable forest management in British Columbia, and includes three major objectives:

- foster sustainable forest management
- improve the public forest asset base
- promote greater returns from the utilization of public timber.

FIA – TIP investments are organized and managed by the FGC and its committees. Council business planning coordinates and leverages FIA – TIP investments with other cooperator investments.

> *"Council's Business Plan coordinates Forest Investment Account spending with cooperator investments and activities."*

Activities in the FGC Business Plan are organized into seven subprograms (Figure 2):

- Gene Conservation
- Tree Breeding
- Operational Tree Improvement (OTIP)
- Expansion of Orchard Seed Supply (SelectSeed Ltd.)
- Extension and Communication
- Gene Resource Information Management
- Seed Orchard Pest Management

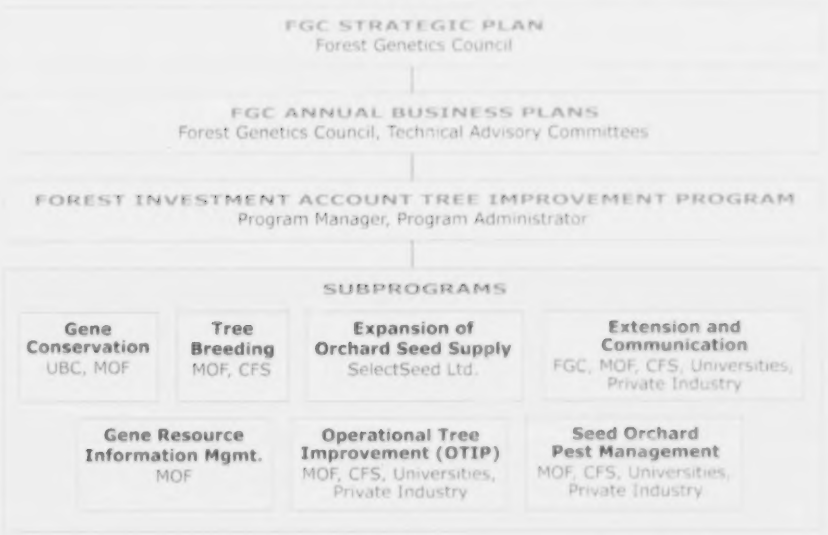


Figure 2
Relationship between FGC strategic and annual business plans, Forest Investment Account TIP, and participants in gene resource management activities.

FIA Funding

TIP annual budget allocations are based on recommendations from the FGC as developed in the FGC Business Plan, and are subject to the budgeting and approval processes of the Forest Investment Council and the Ministry of Forests.

"FIA - TIP annual budgets are based on recommendations from the Forest Genetics Council."

During the 2003/04 fiscal year, the FIA-funded forest gene resource management activities identified in the FGC Business Plan were delivered through three administrative mechanisms:

- Ministry of Forests/UBC Contribution Agreement
- Direct Ministry of Forests Tree Improvement Branch Administration
- Ministry of Forests/SelectSeed Company Ltd. Multi-Year Agreement.

The subprograms associated with each of the agreements are shown in Figure 3.

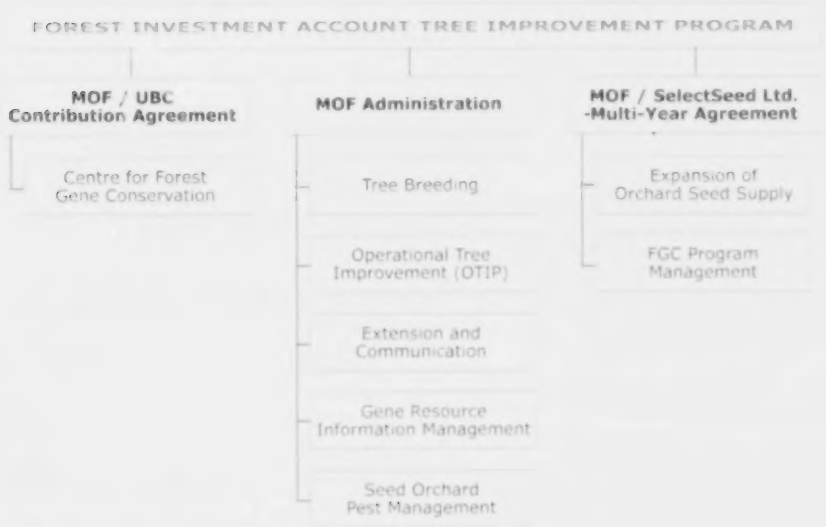

FOREST INVESTMENT ACCOUNT TREE IMPROVEMENT PROGRAM
MOF / UBC Contribution Agreement
Centre for Forest Gene Conservation
MOF Administration
Tree Breeding
Operational Tree Improvement (OTIP)
Extension and Communication
Gene Resource Information Management
Seed Orchard Pest Management
MOF / SelectSeed Ltd. -Multi-Year Agreement
Expansion of Orchard Seed Supply
FGC Program Management

Figure 3
Funding agreements for the delivery of the FIA – TIP.

> *Activities are monitored for performance and progress towards long-term program objectives.*

Monitoring and Reporting

Activities undertaken in the delivery of the FGC Business Plan are monitored for performance relative to specified criteria, and for progress towards long-term program objectives. Performance is planned, monitored, and reported using performance indicators (PIs). These indicators are logical measures of work such as "number of grafts made" or "number of ramets planted." The types of work are organized under a work breakdown structure (WBS) shown in Figure 4. PIs are not feasible for all types of work, and reports are written for technical support, gene conservation, extension, communication, and administrative activities.

Figure 4
Work breakdown structure for program organization, management, and monitoring.

2.0 Forest Genetics Council and Committee Activity 2003/04

During the period of this report, the Forest Genetics Council met quarterly. Primary issues and activities included:

- completing a Strategic Plan for Gene Resource Management for the period 2004 to 2008. This Plan sets out new objectives and Council membership structure;
- changing membership to align Council with the Strategic Plan structure;
- participating in drafting the new *Chief Forester's Standards for Seed Use* in the *Forest and Range Practices Act*, and providing policy advice to the Chief Forester;
- developing a Business Plan for the 2004/05 fiscal year;
- developing a Forest Investment Account Tree Improvement Program budget recommendation for 2004/05;
- providing direction to and receiving reports from committees;
- reviewing and updating bylaws;
- presenting an Achievement Award to Keith Illingworth – Michael de Jong, Minister of Forests, presented the award on behalf of Council; and
- managing committee mandate, structure, and activities in support of objectives.

2.1 Coastal and Interior Technical Advisory Committees (CTAC and ITAC)

The CTAC met in October 2003. The ITAC and affiliated interior species committees met in Vernon and Prince George in November 2003. Principal activities for both committees included:

- reviewing ongoing and new research relevant to gene resource management;
- reviewing species plan strategies for breeding and orchard programs;
- discussing reports from breeders and orchard operators;
- reviewing and commenting on aspects of the *Chief Forester's Standards for Seed Use* in the *Forest and Range Practices Act*;

- developing the OTIP project eligibility list; and
- directing and reviewing reports from affiliated Species Committees.

2.2 SelectSeed Company Ltd. Board of Directors

The SelectSeed Board met in June and October 2003, and February 2004. Principal activities included:

- receiving and approving audited financial statements for the 2002/03 fiscal year;
- addressing business items related to annual reporting requirements of the *Company Act;*
- coordinating and updating of the principal contracts guiding orchard development and management activities; and
- business planning for orchard development activities, and approval of a Business Plan for the 2004/05 fiscal year.

2.3 Other Committees

- The **Extension TAC** met in November 2003. Activities included review of projects, business planning for 2004/05, and transfer of ETAC Coordinator duties.
- The **Gene Conservation TAC** met in December 2003. Activities included review of projects, determination of criteria to rate seed planning units as adequately or inadequately conserved, initiation of new projects on the conservation of tree species of lesser economic interest, business and budget planning for the 2004/05 fiscal year, and strategies for research on the impacts of climate change on species ranges and conservation needs.
- The **Gene Resource Information Management Steering Committee** met in February 2004. Activities included updates on all projects by project leaders, discussion of projects and priorities for 2004/05, and development of a business plan framework for 2004/05.

3.0 FIA Tree Improvement Program 2003/04

3.1 Budgets and Expenditures

Forest Investment Account Tree Improvement Program allocations and expenditures for the 2003/04 fiscal year are shown in Table 1. The table does not include the in-kind, staff, and other substantial inputs by industry, MOF, and university cooperators who contribute to the success of gene resource management activities in B.C.

Subprogram	Budget ($)	Expenditures ($)
Gene Conservation	235,000	235,000
Tree Breeding	2,291,000	2,322,000*
Operational Tree Improvement Program (OTIP)	830,000	798,854
Extension and Communication	45,000	19,970
Gene Resource Information Management	80,000	80,000
Seed Orchard Pest Management	79,000	75,358
Administration	225,000	225,300
Subtotal	**3,785,000**	**3,756,483**
Expansion of Orchard Seed Supply (SelectSeed Ltd.)	1,290,000	1,197,832**
Forest Investment Account Tree Improvement Program Contribution	**$5,075,000**	**4,954,315**

* Additional expenditure approved by the FGC and transferred from other subprograms.
** Actual audited expenditures; difference from budgeted amount carried forward to 2004/05.

Table 1
Summary of Forest Investment Account TIP Subprogram budgets and expenditures for the period April 1, 2003 through March 31, 2004.

3.2 Gene Conservation Subprogram

The maintenance of genetic diversity to allow species adaptation and for the future genetic selection of economically important traits is fundamental to a gene resource management program. Council's gene conservation objectives are met primarily through the Centre for Forest Gene Conservation (CFGC) in the Faculty of Forestry at UBC.[2] CFGC projects contribute to the following five-part strategy of knowledge and technical development by increasing our understanding of: (1) the current extent of forest genetic resources, including species distributions, and the amount and distribution of genetic variation within species; (2) the degree to which species are conserved *in situ* in

> *"Maintaining genetic diversity is a necessary component of long-term forest management."*

[2] Web site: http://www.genetics.forestry.ubc.ca/cfgc.

protected areas throughout their ranges; (3) patterns of climatic or ecological variation that are likely to coincide with adaptive patterns of genetic variation as well as species ranges; (4) the extent of *ex situ* genetic resources, e.g., in seed storage; and (5) optimal sampling strategies for conserving genetic diversity through *in situ* and *ex situ* protection, particularly given the challenge of a rapidly changing climate.

CFGC accomplishments in 2003/04 included:

- development of a climatic prediction model that allows predictions of the future range distributions of native species under various climate change scenarios;
- completion of a project on the optimal sampling strategies for capturing allelic diversity in *ex situ* conservation collections;
- detailed range maps for 11 conifers and evaluation of the degree of protection for these species (results appear in FGC species plans as part of the 2004/05 FGC Business Plan);
- estimation of the degree of representation in protected areas for an additional 49 species;
- continued progress on the genetics and restoration strategies for whitebark pine (*Pinus albicaulis*); and
- leverage of FIA – TIP funding by acquiring joint grant support from NSERC and the BIOCAP Canada Foundation.

Table 2 sets out the planned and completed products for the 2003/04 fiscal year.

Table 2
Summary of Gene Conservation Subprogram projects, planned products and products achieved for the period April 1, 2003 through March 31, 2004.

Project	Planned products	Products achieved
Theoretical framework document(s)	1 report	0 (product embedded in other projects)
Genetic issues in certification	1 report	1 paper published
Cataloguing and documenting *in situ* protection	53 SPUs / 12 maps	49 SPUs / 11 maps
Sampling strategies and SPZs	1 final report	1 final report
Markers and theory for measuring diversity	1 progress report	1 progress report; 1 paper published
Whitebark pine diversity and conservation	1 progress report	1 progress report; 1 paper published
Genetic structure of minor species	48 species distribution maps	48 species distribution maps and protection status
Extension	100 clients served; / Web site update	~200 clients served; ~ 1090 unique visitors to updated Web site

3.3 Tree Breeding Subprogram

The Tree Breeding Subprogram seeks to understand and use the genetic variation of commercial tree species in B.C. This work includes genecology[3] research to develop seed transfer limits, and the continual improvement of the genetic worth (GW)[4] of seed and vegetative materials transferred to seed orchards. Tree breeding activities include selecting parents in wild stands, propagating, testing offspring, mating, establishing/maintaining/measuring trials, and associated research. The MOF Research Branch manages and undertakes Tree Breeding Subprogram activities. FGC Interior and Coastal TACs and their associated Species Committees assist MOF tree breeders with planning for the Tree Breeding Subprogram.

Figure 5 shows the allocation of effort to Tree Breeding Subprogram activities in 2003/04. Figure 6 compares the work completed under each activity to work planned for the fiscal year.

> *Tree breeding programs seek to reveal genetic diversity patterns; information that can be used to select parent trees for producing seed of high genetic quality.*

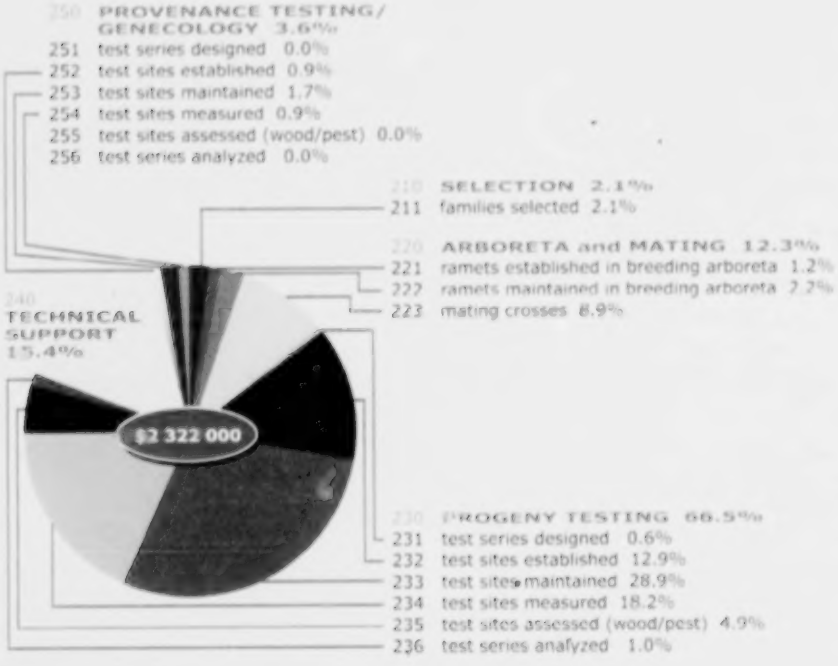

250 PROVENANCE TESTING/ GENECOLOGY 3.6%
251 test series designed 0.0%
252 test sites established 0.9%
253 test sites maintained 1.7%
254 test sites measured 0.9%
255 test sites assessed (wood/pest) 0.0%
256 test series analyzed 0.0%
210 SELECTION 2.1%
211 families selected 2.1%
220 ARBORETA and MATING 12.3%
221 ramets established in breeding arboreta 1.2%
222 ramets maintained in breeding arboreta 7.2%
223 mating crosses 8.9%
240 TECHNICAL SUPPORT 15.4%
$2 322 000
230 PROGENY TESTING 66.5%
231 test series designed 0.6%
232 test sites established 12.9%
233 test sites maintained 28.9%
234 test sites measured 18.2%
235 test sites assessed (wood/pest) 4.9%
236 test series analyzed 1.0%

Figure 5
Tree Breeding Subprogram allocation of effort, 2003/04.

[3] Genecology is the relationship between genetic diversity and environments.

[4] Genetic worth is a measure of the genetic quality of a seed or vegetative lot over wild stand material, measured for a specific trait (e.g., growth, wood density, pest resistance).

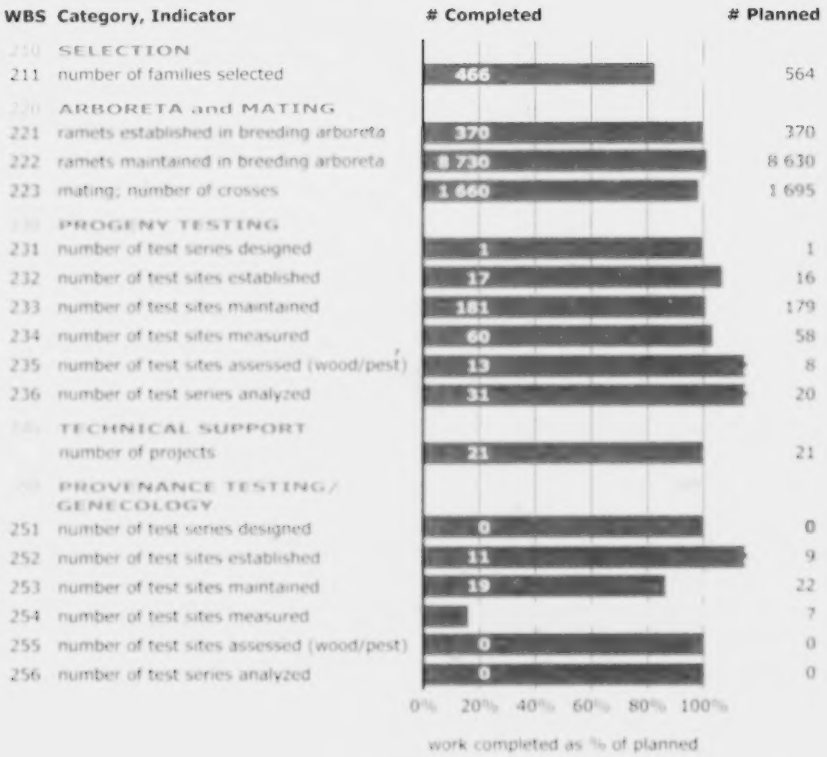


Figure 6
Tree Breeding Subprogram progress, 2003/04.

> *"Trees of high genetic quality are selected for seed production in seed orchards."*

Progress in Operational Breeding

Operational breeding program objectives were met or exceeded for most seed planning units (SPUs) during the fiscal year. Maturing programs in many SPUs have shifted the focus to completion of breeding and progeny test establishment for a second generation (F1 – full-sib).[5] There is also an increasing emphasis on pest resistance and wood quality.

Interior Breeding Program Highlights:

- Second-generation matings of lodgepole pine (Pli) were completed for five SPUs (low elevation Prince George, Bulkley Valley, Thompson–Okanagan, Nelson, and Central Plateau).
- Second-generation seedlings were grown for Bulkley Valley Pli progeny tests.
- Six 20-year-old interior spruce (Sx) sites were measured and maintained.
- Weevil (*Pissodes strobi*) testing continued with the controlled release of 10,000 weevils in a Thompson–Okanagan polycross test.

[5] F1 – full-sib populations are the first generation of pedigree families where both parents of all offspring are known and selected for specific desirable traits. Most provincial programs started with open-pollinated testing in the first generation.

- 359 second-generation controlled-crosses were completed for Douglas-fir (Fdi), and 82 were completed for western larch (Lw).
- Five 15-year-old and two 20-year-old Fdi tests in the Nelson and Cariboo Transition zones were measured.

Coastal Breeding Program Highlights:

- Second-generation (F2 and polycross) Douglas-fir (Fdc) testing advanced with 200 crosses completed, and series 1 tests measured at age 5.
- Age 7 heights from two high-elevation Fdc progeny tests were measured and analyzed.
- Two F1 progeny test sites of Sitka spruce (Ss) were established from crosses made among parents showing high levels of weevil resistance.
- Second-generation breeding of western hemlock (Hw) continued to advance with American cooperators, with over 100 selections of superior progeny made to date.
- Nine redcedar (Cwr) polycross tests were planted, bringing this test series to a total of 39 of a planned 42 sites.
- Sixty Cwr trees from a progeny test were selected for deer-browse resistance and high needle monoterpene concentration.
- Two test series of yellow-cedar (Yc) were measured at age 5, and clonal values for 3,000 trees were calculated and made available.

"The oldest coastal Douglas-fir second generation (F2) progeny tests were measured at age 5; selections will eventually support third-generation seed orchards."

Provenance Testing and Genecology

Provenance testing and genecology work are primarily focused on SPUs where past testing was not done, or where research is insufficient to clearly establish seed zone boundaries. Some work may also identify superior provenances for seed collection. Highlights include:

- A new Sx genecology study focusing on central B.C. populations (Prince George SPU) was established on three field sites and one nursery site. This project will help refine seed zone boundaries, aid with breeding value determinations for range of older progeny test series, and assist with seed transfer response to climate change scenarios.
- Initiation of the largest genecology study of interior spruce ever undertaken in western North America. One hundred populations from New Mexico (latitude 35°N) to the Northwest Territories (latitude 65°N) will be tested with 27 seed orchard (Class A) and improved populations at 15 test sites in B.C., Alberta, and the Yukon. Seed were sown in spring 2004 for spring 2005 planting. Results will enable refinement of seed transfer protocols that will maximize field productivity of Class A and B seed. This project is partially funded by the Climate Change Action Fund of Environment Canada.

"Provenance tests provide data on the geographic patterns of genetic diversity."

- Seedlings were grown for high elevation Pli provenance/family screening trials in the Thompson-Okanagan and Big Bar/Chilcotin areas. A consortium of central interior forest companies led by West Fraser Timber and Weyerhaeuser is establishing field tests.

3.4 Operational Tree Improvement (OTIP) Subprogram

"OTIP focuses on increasing the quality and quantity of seed produced from existing seed orchards."

The OTIP Subprogram focuses on increasing the quality and quantity of select seed produced from provincial seed orchards. It also provides technical support to improve orchard production and management.

OTIP projects are developed through a call-for-proposals process based on Species Plan priorities. FGC Review Committees rank all proposals against FGC objectives and SPU priorities, based on technical merit, impact, value, and cost. The MOF Tree Improvement Branch administers the OTIP Subprogram on behalf of Forest Investment Account and the FGC.

Figure 7 shows the allocation of funding to OTIP Subprogram activities in 2003/04. Figure 8 compares the work completed under each activity to work planned for the fiscal year.

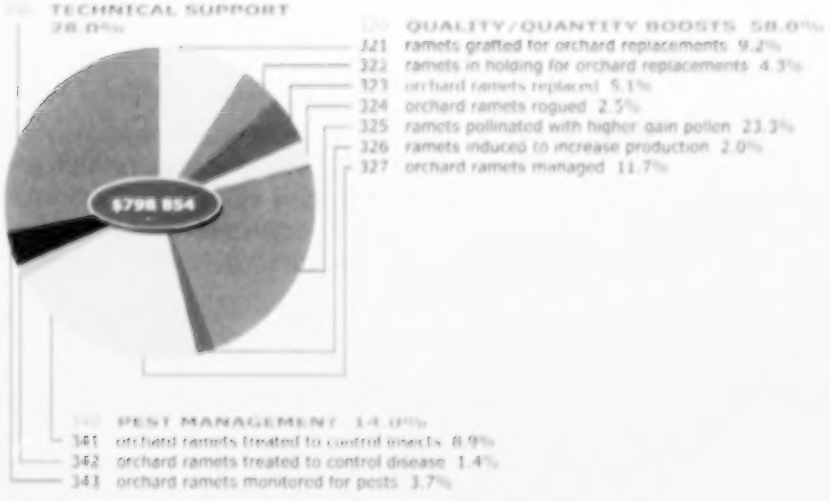

TECHNICAL SUPPORT
28.0%
QUALITY/QUANTITY BOOSTS 58.0%
321 ramets grafted for orchard replacements 9.2%
322 ramets in holding for orchard replacements 4.3%
323 orchard ramets replaced 5.1%
324 orchard ramets rogued 2.5%
325 ramets pollinated with higher gain pollen 23.3%
326 ramets induced to increase production 2.0%
327 orchard ramets managed 11.7%
$798 854
PEST MANAGEMENT 14.0%
341 orchard ramets treated to control insects 8.9%
342 orchard ramets treated to control disease 1.4%
343 orchard ramets monitored for pests 3.7%

Figure 7
OTIP Subprogram allocation of effort, 2003/04.

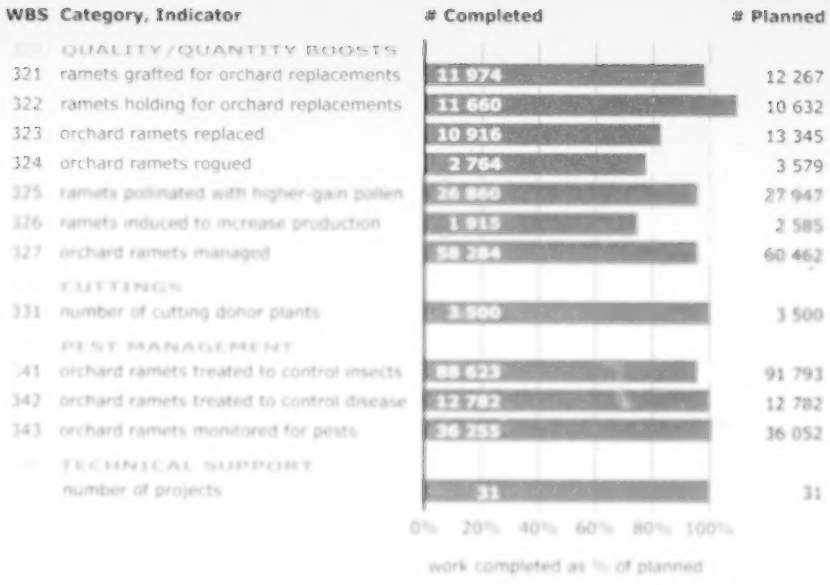


Figure 8
OTIP Subprogram progress, 2003/04.

Quality/Quantity Boosts

The genetic quality and/or quantity of orchard seed is improved through a number of techniques, including incorporating new selections from breeding programs in seed orchards to replace lower-gain ramets, supplemental mass pollination (SMP), controlled pollination (CP), induction of reproductive buds through hormonal or cultural treatments (i.e., girdling), and management of crown growth. The following progress was made on specific activities during 2003/04.

> "Techniques to improve the genetic quality and quantity of orchard seed include introducing new selections from breeding programs, using high quality pollen, and inducing ramets to produce more reproductive buds."

WBS 321: 98% of grafting for the replacement of stock in existing orchards was completed as planned.

WBS 322: More ramets than anticipated were maintained in holding beds for two reasons: fewer than planned ramets being planted in orchards, and the need to hold material beyond the year end.

WBS 323: 82% of planned orchard ramet replacement was done. Two coastal orchard projects were delayed due to site drainage issues, and will be completed in the summer of 2004/05.

WBS 324: 77% of planned orchard roguing was carried out. Delay of a coastal Douglas-fir project until after the fiscal year-end accounts for most of the shortfall. This work will proceed.

WBS 325: 96% of planned SMP and CP projects were carried out. The 2002 orchard crops were moderate in size, and projects generally proceeded as planned.

WBS 326: 74% of planned ramet induction of reproductive buds was completed. Shortfalls are due primarily to a large coastal Douglas-fir cone

crop that limited the number of trees available for induction, and deferral of a lodgepole pine (Thompson–Okanagan) project.

WBS 327: 96% of the planned number of ramets in orchards and holding beds were managed to control crown growth and shape, control weeds, and maintain identities.

Pest Management

Insects and disease can damage cones or reduce the vigour and cone production of orchard ramets. Treatments to control insects and disease are only undertaken when needed. Orchard ramets are monitored for pest problems for early detection and effective control.

WBS 341: 91% of planned insect control treatments were done. There were fewer insect problems than anticipated and some treatments were cancelled.

WBS 342 and 343: All planned disease control treatments and monitoring projects were carried out.

Technical Support

"Technical support projects investigate ways to improve the production of high-quality seed."

Seed orchard technical support projects are designed to remove barriers to producing seed of high quality for operational use.

WBS 350: Thirty-one technical projects addressed priority issues, including seed-set problems in southern lodgepole pine orchards, pest management measures, pollen management to improve genetic worth and seed production, and orchard management techniques. All projects were completed or are on schedule.

3.5 Expansion of Orchard Seed Supply Subprogram (SelectSeed Company Ltd.)

"SelectSeed's investments are based on the planning processes led by Council."

SelectSeed Company Ltd. (SelectSeed) is a corporation wholly owned by the B.C. Forest Genetics Society and reporting to Council. SelectSeed's mandate is to develop and manage orchard expansions needed to meet FGC objectives, and not undertaken by other companies or agencies. SelectSeed also provides program management services to the FGC.

SelectSeed's Business Plan and investments are based on the long-term and annual business plans prepared by FGC TACs and Species Committees. Management discretion lies with the SelectSeed Board of Directors, and is guided by the terms of the multi-year agreement between SelectSeed and the Province of British Columbia. Agreements between private orchard companies and SelectSeed take the form of long-term contracts that provide stability for investment and orchard management. The SelectSeed Business Plan is reviewed and approved annually by the FGC.

SelectSeed Mission Statement

SelectSeed supports Forest Genetics Council objectives for the development of seed orchard facilities to meet the provincial demand for high quality, ecologically adapted tree seed through investments, cooperative work with FGC members, and effective program management.

Figure 9 shows funding allocations to Expansion of Orchard Seed Supply Subprogram activities in 2003/04. Figure 10 compares the work completed under each activity to work planned for the fiscal year.

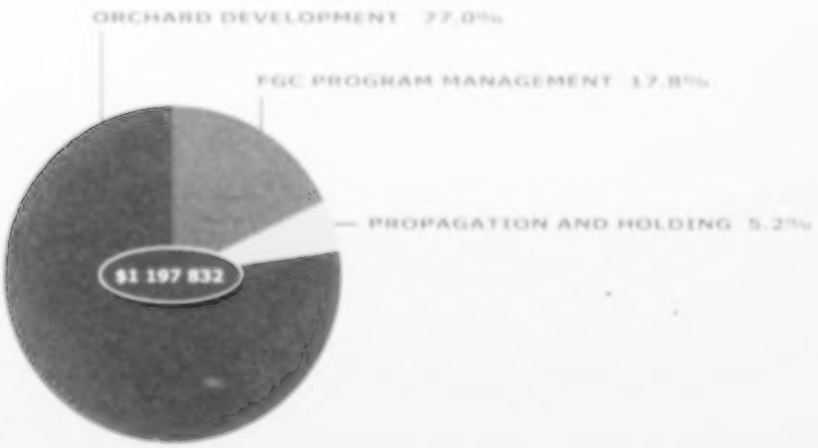


Figure 9
Expansion of Orchard Seed Supply Subprogram allocation of effort, 2003/04.

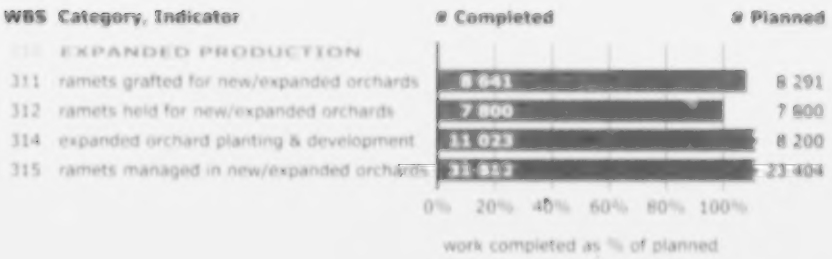


Figure 10
Expansion of Orchard Seed Supply Subprogram progress, 2003/04.

Orchard Development and Production

Through contracts to orchard companies, SelectSeed carries out orchard development, propagation of selected parent trees through grafting, and orchard management. All activities were undertaken to meet objectives in the FGC Business Plan.

In its fourth year of operation, SelectSeed focused on completing the propagation and planting of 14 seed orchards. No new orchards were initiated during the year. Over 11,000 ramets were planted, bringing the total

> *In its fourth year of operation, SelectSeed focused on completing propagation and planting of 14 seed orchards.*

number of ramets established across the 14 orchard developments to nearly 32,000 of 35,320 planned (90%). All significant site development activities were completed during the year. The first small crop from a SelectSeed orchard was collected (orchard 321 - Douglas-fir NE low), and subsequently sold.

Fiscal year 2003/04 marked the last year of large orchard development projects, and the shift of focus for SelectSeed to management and crop production. Although time is required for orchards to mature and crops to reach substantial levels, the coming years will see a rise in seed produced and an increase in sale revenues.

The following activities were carried out in 2003/04.

WB 311: 8,641 ramets of lodgepole pine, Douglas-fir, and spruce were propagated.

WBS 312: 7,800 ramets were maintained in holding beds; most of which were outplanted during the year.

WBS 314: 11,023 ramets were planted in orchards.

WBS 315: 31,812 ramets are established in all SelectSeed orchards as of March 31, 2003 (90% of total planned development is complete).

SelectSeed Ltd. Management

SelectSeed activities in 2003/04 included:

- organizing and managing contracts for the propagation and holding of stock;
- managing orchard contracts, including planning, support for orchard contractors, stock allocations, workplan development, and records maintenance;
- preparing an annual Business Plan covering business procedures, budgets, and long- and short-term activities;
- reporting to FIA administrators on accounts and activities; and
- managing accounts and corporate business.

FGC Program Management

FGC program management activities included developing the FGC Business Plan for 2003/04; organizing committee work for development of the 2004/05 FGC Business Plan; policy, committee, issue management, and reporting for the FGC; and financial management of the overall FIA Tree Improvement Program.

3.6 Extension and Communication Subprogram

The Extension and Communication Subprogram supports FGC goals and objectives through extension, communication, and education activities. These activities are developed and guided by the FGC Extension Technical Advisory Committee (ETAC), which includes representatives from government, industry, seed dealers, academia, and consultants.

Figure 11 shows funding allocations to the Extension and Communication Subprogram activities in 2003/04.

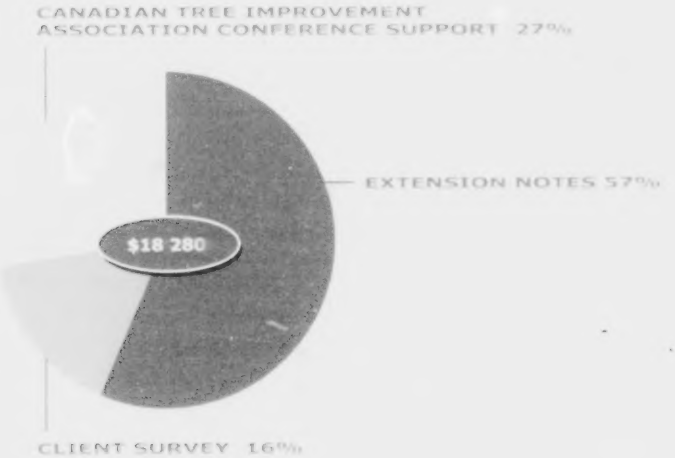


Figure 11
Extension and Communication Subprogram allocation of effort, 2003/04.

FGC Program Communications

FGC communications focus on activities pertinent to the provincial forest gene resource management program. In 2003/04 these included the preparation of annual plans, and maintenance of the FGC Web site. Activities were partly curtailed due to policy changes with the development of the *Forest and Range Practices Act*.

During the reporting period, development began on an extensive client survey to assess the effectiveness and usability of gene resource management extension products. This project will be completed in the 2004/05 fiscal year.

> "*The Extension and Communication Subprogram activities serve public, technical, and decision-making audiences.*"

Extension and Communication Projects

The following extension notes will be available on the Web and in print form early in 2004/05:

- *The Reproductive Biology of Western White Pine* (J. Owens)
- *Application of DNA Markers in B.C. Tree Improvement Programs* (C. Newton)
- *Environmental Effects on Yellow-cedar Pollen Quality* (O. Hak and J. Russell)

3.7 Gene Resource Information Management Subprogram

> *The Gene Resource Information Management Subprogram develops tree gene resource registries and information management tools to assist seed users.*

The Gene Resource Information Management Subprogram supports the development of tree gene resource registries and land-based gene resource management (GRM) and planning tools. These tools will improve client access to gene resource information to support genetically selected seed use for reforestation, incorporate genetic gain into timber supply analyses, support seed deployment and gene conservation strategies, and develop land-based effectiveness monitoring programs. Projects under this subprogram include the development of gene resource spatial data to support client access to seed planning and gene resource management maps (e.g., seed collection, deployment, and gene conservation activities).

A Steering Committee develops Gene Resource Information Management activities and budgets. The Committee—comprised of MOF tree improvement, research, and systems staff; industry representatives; and the FGC Program Manager—identifies projects and sets priorities for FGC approval. The Tree Improvement Branch administers the subprogram on behalf of the MOF's Forest Investment Account (FIA).

Figure 12 shows funding allocations to the Gene Resource Information Management Subprogram activities in the 2003/04 fiscal year.

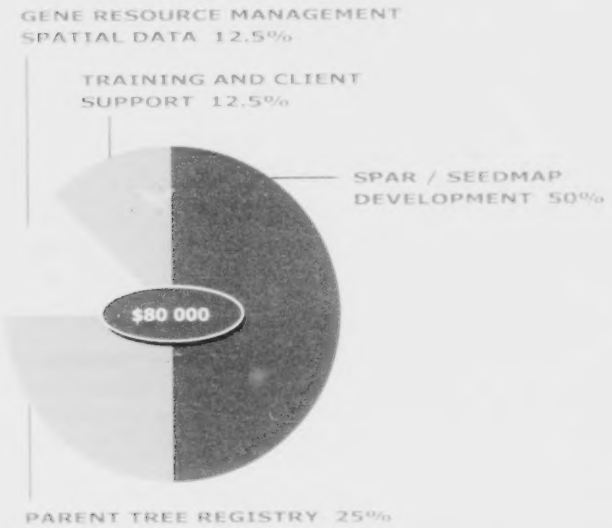

GENE RESOURCE MANAGEMENT SPATIAL DATA 12.5%
TRAINING AND CLIENT SUPPORT 12.5%
SPAR / SEEDMAP DEVELOPMENT 50%
$80 000
PARENT TREE REGISTRY 25%

Figure 12
Gene Rescurce Information Management Subprogram allocation of effort, 2003/04.

Accomplishments

- Full implementation of a Web-based Seed Planning and Registry system (SPAR) in support of on-line annual seed registration, testing, storage, and use, and identification of design specifications for a new Web-based parent tree registry within SPAR.
- Implementation of the new Web-based SeedMap viewer and summary reporting tool.
- Development of seed use and gene resource management information reporting requirements under the new *Forest and Range Practices Act*.
- Development of natural stand seed planning zone digital maps.
- Development of Web-based training modules and on-line help documentation.
- Integration of GRM within other forestry analyses, including forest health (mountain pine beetle) and timber supply.

3.8 Seed Orchard Pest Management Subprogram

This is the first year for the Seed Orchard Pest Management Subprogram. This program supports research on high priority pests that affect the ability of provincial seed orchards to meet FGC objectives for seed production and gain. The Pest Management Technical Advisory Committee, which sets priorities on specific orchard pests, guides investments. A competitive call for proposals resulted in four projects.

Accomplishments

- A collaborative project with the Canadian Forest Service and the University of California seeks to develop a pheromone attractant for fir coneworm (*Dioryctia abietivorella*). A range of pheromone extracts was tested, with focus on one extract that shows promise. Pheromone blends are being field tested in Vernon, B.C.; Chico, California; and Quebec.
- The western conifer seed bug (*Leptoglosssus occidentalis*) is considered to be the principal insect pest reducing seed production in lodgepole pine seed orchards. Control mechanisms are limited. Work progressed on the identification of male communication signals through both pheromones and sonic signals. Of 183 essential oils screened, one produced positive results. Sonic signals were investigated, and some success achieved in attracting female cone bugs. Both the pheromone and sonic signals will be further tested in 2004.

- A collaborative project between the B.C. Ministry of Forests, Canadian Forest Service, and Institut National de Recherches Agronomiques (France) proceeded on the identification of species and ranges of seed chalcids (*Megastigmus* spp.), and on the identification of parisitoid insects. Seed samples were obtained from approximately 50 natural stand and orchard seedlots. Insects from highly infected samples are being reared and analyzed to identify species and parisitoids.
- Fungal assays were conducted for 129 seedlots stored at the Provincial Seed Centre for three fungal species common in seedling nurseries. Results were made available to seed users to help increase nursery recoveries.

3.9 Administration

Administration of Forest Investment Account Tree Improvement Program funding is carried out by the MOF Tree Improvement Branch, and includes financial, monitoring, and reporting services. The administrative infrastructure for the Tree Breeding, OTIP, Extension and Communication, and Gene Resource Information Management Subprograms is provided directly. Administration of the Gene Conservation and Orchard Expansion Subprograms is carried out under contract.

4.0 Provincial Progress Indicators

During the period of this report, the Forest Genetics Council completed a new Strategic Plan for 2004 to 2008. Two of the principal objectives in the Strategic Plan are to increase the average volume gain (genetic worth for growth, or GWg) of select seed to 20% by 2020, and to increase select seed use to 75% of total provincial sowing by 2013. Figures 13 and 14 show, respectively, actual and forecast values for select seed/rooted cutting production and GWg for the period 1995–2024.[6]

Forecasts indicate that both objectives will be met, and that actual GWg (Figure 13) seed use (Figure 14) are on track.

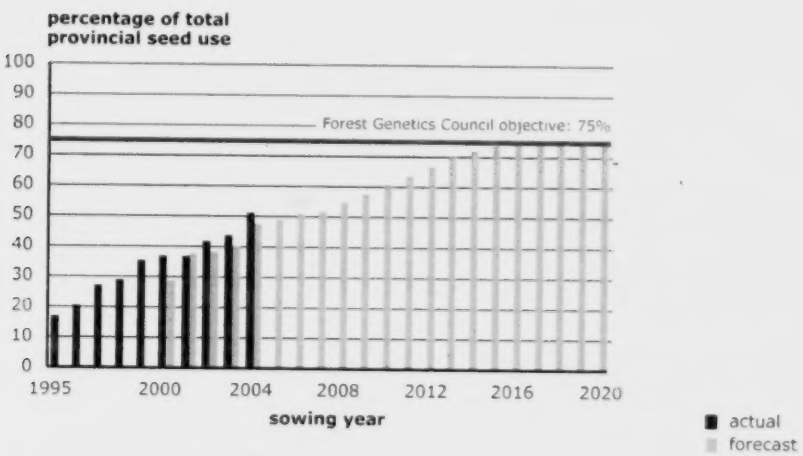


Figure 13
Actual and Species Plan forecasts of select seed production as percentage of provincial seed use.

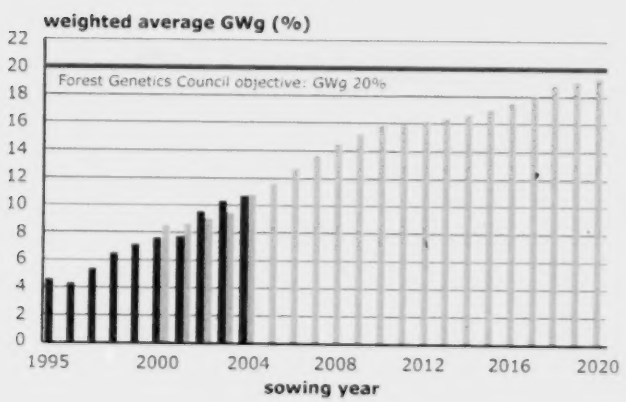


Figure 14
Actual and Species Plan forecasts of average genetic worth for growth (GWg) of select seed in B.C.

[6] Until 2001, the term "select seed" referred to orchard seed with GW ≥ 0. In 2001, the definition was expanded to include B+ seed (GW ≥ 0). As a result, actual values in Figures 15 and 16 for 2000 and beyond include a small amount of B+ seed. All other values include only orchard seed.

During the 2004 sowing year, select seed use increased to 51.6% from 44% the previous year (Figure 13). This included 41.5% orchard seed (class A), and 10.1% superior provenance seed (class B+). These increases were due to higher availability of orchard seed for spruce and lodgepole pine in interior seed planning units, and increased use of lodgepole pine superior provenance seed. Provincially, the use of select seed increased to 116 million seedlings from 84.3 million the previous year.

Projected use of orchard seed will continue to rise, mainly due to an expected increase in the supply of lodgepole pine seed produced in new orchards established during the last three years (primarily by SelectSeed Company Ltd.).

The rising average GWg of orchard seed (figure 14) used is being driven largely by high-gain interior spruce and western larch orchard production. This average will continue to rise as interior Douglas-fir orchards come on stream, and as the new high-gain lodgepole pine orchards ramp up production. These gains reflect the focused effort of seed orchard managers to upgrade seed orchards, and of tree breeders to provide recommendations and improved materials. The OTIP Subprogram is instrumental in supporting this continual upgrade of orchards.

During 2003/04, orchards established under contract to SelectSeed Company Ltd. neared completion. These orchard sites are now fully developed and 90% planted, with close to 32,000 ramets established as of March 31, 2004. In combination with industry and Ministry of Forests seed orchards, they will bring total provincial orchard capacity to the level needed to meet FGC long-term objectives.

4.1 2003 Seed Orchard Crops

In 2003, all provincial orchards produced a combined crop of over 1,113 kilograms of seed, sufficient to grow approximately 98 million seedlings (Table 3; Appendix 2). Interior spruce crops, although down from 2002, again dominated this total with sufficient seed to grow about 54 million seedlings. Western larch and lodgepole pine crops continue to increase. Coastal Douglas-fir production increased as second-generation orchards mature, with enough seed produced to grow over 15 million seedlings.

> *"Provincial seed orchards produced sufficient seed for 98 million seedlings."*

Table 3
Summary of 2003 seed crops from all provincial orchards.

Species	Seed produced (kg)	Seedling equivalents (million)
Interior spruce	374.5	55.0
Lodgepole pine	110.0	12.8
Western larch	108.0	9.2
Interior Douglas-fir	6.2	0.2
White pine	79.5	1.2
Western redcedar	6.7	1.3
Coastal Douglas-fir	367.0	15.0
Western hemlock	18.3	3.6
Pacific silver fir	42.5	9.2
	1093.7	98.0

5.0 The Year Ahead

After five years of successful business planning and program delivery, the activities delivered under the guidance of the Forest Genetics Council are well organized and meeting objectives. The following challenges will require Council's attention in the coming year:

- The provincial government has set up a Forest Science Board (FSB) to develop a strategic plan and annual business plans for the delivery of provincial funds to forest science research. Alignment with federal agencies and universities is part of this strategy. The relationship between the FSB and the FGC will require attention during 2004/05, and may impact future delivery of components of the existing gene resource management program.
- Technical details in the *Forest and Range Practices Act Chief Forester Standards for Seed Use* will require completion. Although the principal components of the Standards are finalized, it is critical that the technical details on issues such as seed transfer, seedlot gain estimates, and seed registration are accurate and fully reflect current scientific knowledge.
- The alignment of seed orchard capacity to seed planning unit plans and FGC objectives is largely complete due to the cooperation of FGC affiliates. However, some issues remain, and will need to be addressed by species committees.
- Economic difficulties in the B.C. forest industry continue, placing increased emphasis on the return of value for all investments, including tree improvement. Delivery of value includes high gain in commercial traits, keeping orchard seed cost low, diverting resources to higher impact SPUs and program areas, and maintaining focus on gene resource stewardship.
- The timely delivery of accurate information to operational foresters when they engage in seed planning is a critical extension obligation. Current information systems have generally met this need well. Improvements in seed forecasting, information access, and training will continue to be challenges.

6.0 People

FGC Achievement Award

Keith Illingworth

An FGC Achievement Award was presented to Keith Illingworth on February 13, 2004, for his outstanding contributions to provincial genecology research and to tree improvement management in British Columbia. Mr. Illingworth's career began with the Ministry of Forests in 1955. His visionary research in lodgepole pine genecology has become a landmark study with extensive and long-term implications for management of the species. He was also one of the founding members of the Interior Tree Improvement Council, later to become part of the Forest Genetics Council. The Achievement Award was presented by Michael de Jong, Minister of Forests, on behalf of the FGC.

Mr. Keith Illingworth receiving an FGC Achievement Award from the Honourable Michael de Jong, Minister of Forests

Retirements

Don Summers

After 23 years, Don Summers retired from the Tree Improvement Branch of the Ministry of Forests tib). Don's career began in the area of pest management, where he specialized in pests impacting seed orchards. At the time of his retirement, Don was Manager of Extension Services, TIB, and contributed to the FGC Extension Subprogram as ETAC Coordinator.

Dave Walden

Dave Walden's career with the Ministry of Forests began in 1969. During this time Dave worked as the Research Technician responsible for the extensive interior spruce tree breeding program. His dedication and thoroughness to detail have been instrumental in the success of this program.

Terry Carter

Following 35 years of service to the Ministry of Forests, Terry Carter retired as Orchard Technician at the Bailey site of the Kalamalka Seed Orchards. Terry's career included many areas of tree improvement, from early parent tree selection work to many aspects of orchard management.

Appendix 1. Seed planning units

Seed planning unit (SPU)				
#	Species	Seed zone symbol	Seed zone name	Elevation band (m)
1	Fdc	M	Maritime	< 700
2	Cw	M	Maritime	< 600
3	Hw	M	Maritime	< 600
4	Sx	NE	Nelson	1000-1500
5	Sx	NE	Nelson	> 1500
6	Ss	M	Maritime	< 750
7	Pli	NE	Nelson	< 1400
8	Pw	M/SM	Maritime / Submaritime	< 1000
9	Ba	M	Maritime	< 1000
10	Pli	TO	Thompson-Okanagan	< 1400
11	Yc	M	Maritime	< 1200
12	Pli	PG	Prince George	< 1200
13	Lw	NE	Nelson	< 1300
14	Sx	PG	Prince George	< 1200
15	Pw	KQ	Kootenay Quesnel	< 1400
16	Pli	TO	Thompson-Okanagan	> 1400
17	Pli	BV	Bulkley Valley	< 1200
18	Pli	CP	Central Plateau	< 900 N of 56° < 1100 S of 56°
19	Fdc	SM	Submaritime	200-1000
20	Pli	NE	Nelson	> 1400
21	Fdi	NE	Nelson	< 1000
22	Fdi	NE	Nelson	> 1000
23	Sx/Ss	SM/NST	Submar./Nass Skeena Transition	all
24	Hw	M	Maritime	> 600
25	Sx	EK	East Kootenay	< 1700
26	Pli	PG	Prince George	> 1200
27	Cw	SM	Submaritime	200-1000
28	Sx	TO	Thompson-Okanagan	1300-1850
29	Pli	EK	East Kootenay	> 1500
30	Sx	TO	Thompson-Okanagan	< 1300
31	Fdc	M	Maritime	> 700
32	Pli	EK	East Kootenay	< 1500
33	Cw	M	Maritime	> 600
34	Lw	EK	East Kootenay	800-1500
35	Sx	BV	Bulkley Valley	< 1200
36	Bg	M	Maritime	< 700
37	Fdi	QL	Quesnel	< 1200
38*	Hw	M	Maritime	> 600
39	Fdi	EK	East Kootenay	all
40	Sx	PR	Peace River	650-1200
41	Fdi	PG	Prince George	< 1000
42	Sx	PG	Prince George	> 1200
43	Fdi	CT	Cariboo Transition	< 1100
44	Sx	NE	Nelson	< 1000
45	Pli	CHL /BB	Chilcotin / Big Bar	all
46	Bl	NST / all int.	Nass Skeena Transition/all interior	all
47	Bn	M	Maritime	> 600
48	Hardwoods	Interior		
49	Hardwoods	Coast		

* SPU 38 has been merged with SPU 3 for planning purposes.

Appendix 2. Summary of 2003 seed orchard crop production

Species	SPU	Orch. #	Producer	GWg	Cones (hL)	Seed (kg)	Estimated # seedl. (x1000)
Coastal Douglas-fir	M high	116	Canadian Forest Prod.	2	70.0	16.5	541.7
Coastal Douglas-fir	M low	134	TimberWest	9	65.0	22.5	781.2
Coastal Douglas-fir	M low	134	TimberWest	7	40.0	14.1	480.1
Coastal Douglas-fir	M low	134	TimberWest	4	69.0	24.7	1,126.2
Coastal Douglas-fir	M low	149	MOF - Bowser	7	196.0	103.3	4,770.4
Coastal Douglas-fir	M low	149	MOF - Bowser	14	4.3	1.2	46.1
Coastal Douglas-fir	M low	154	TimberWest	10	44.0	11.3	404.9
Coastal Douglas-fir	M low	154	TimberWest	7	85.0	26.6	802.6
Coastal Douglas-fir	M low	154	TimberWest	5	75.0	19.0	574.1
Coastal Douglas-fir	M low	162	MOF - Bowser	11	91.8	51.0	2,410.3
Coastal Douglas-fir	M low	162	MOF - Bowser	21	1.0	0.4	14.8
Coastal Douglas-fir	M low	162	MOF - Bowser	7	67.0	30.3	1,283.0
Coastal Douglas-fir	M low	166	Western Forest Prod.	15	10.3	5.3	193.8
Coastal Douglas-fir	M low	166	Western Forest Prod.	10	45.3	18.7	775.5
Coastal Douglas-fir	M low	169	Western Forest Prod.	11	10.7	3.6	114.1
Coastal Douglas-fir	M low	183	TimberWest	13	32.0	16.6	628.5
Coastal Douglas-fir	SM low	181	MOF - Saanich	2	7.0	2.0	74.0
Interior Douglas-fir	CT all	231	Vernon Seed Orch. Co.	18	4.0	0.7	25.3
Interior Douglas-fir	NE low	321	PRT - Armstrong	26	2.5	0.7	22.2
Interior Douglas-fir	QL all	226	Vernon Seed Orch. Co.	10	16.8	4.8	156.6
Interior spruce	BV low	208	MOF - Skimikin	13	37.8	42.7	5,275.1
Interior spruce	BV low	620	MOF - Vernon	25	5.3	4.2	518.8
Interior spruce	EK all	304	MOF - Vernon	24	135.8	153.2	20,643.1
Interior spruce	NE high	302	MOF - Skimikin	4	4.2	3.2	513.5
Interior spruce	NE high	306	MOF - Vernon	12	11.2	8.8	1,237.0
Interior spruce	NE mid	305	MOF - Vernon	12	16.4	12.5	1,913.9
Interior spruce	PG low	211	Vernon Seed Orch. Co.	25	102.4	47.8	5,522.4
Interior spruce	TO low	303	Riverside Forest Prod.	11	53.4	46.1	8,892.0
Interior spruce	TO low	303	Riverside Forest Prod.	10	59.8	56.0	10,430.2
Lodgepole pine	BV low	219	Vernon Seed Orch. Co.	12	93.0	17.6	1,877.4
Lodgepole pine	BV low	228	MoF - Prince George	6	38.0	14.4	1,847.4
Lodgepole pine	CP low	218	Vernon Seed Orch. Co.	8	22.0	1.8	238.4
Lodgepole pine	CP low	223	MOF - Prince George	6	4.6	1.7	228.2
Lodgepole pine	NE low	307	MOF - Vernon	7	104.5	35.7	3,964.2
Lodgepole pine	NE low	307	MOF - Vernon	7	15.3	3.9	544.1
Lodgepole pine	NE low	313	PRT - Armstrong	16	30.6	8.7	1,039.4
Lodgepole pine	PG low	220	MOF - Prince George	6	10.1	3.1	394.6
Lodgepole pine	PG low	222	Vernon Seed Orch. Co.	10	30.0	3.1	299.7
Lodgepole pine	TO high	310	Riverside Forest Prod.	10	19.5	2.0	230.2
Lodgepole pine	TO low	308	PRT - Armstrong	6	50.1	8.4	1,026.8
Lodgepole pine	TO low	311	PRT - Armstrong	15	41.5	9.4	1,127.2
Pacific silver fir	M low	129	TimberWest	2	19.0	42.5	154.5
Redcedar	M low	140	TimberWest	5	4.0	1.2	196.8
Redcedar	M low	184	MOF - Saanich	5	0.9	0.7	169.3
Redcedar	M low	186	Canadian Forest Prod.	5	2.2	2.6	428.3
Redcedar	M low	186	Canadian Forest Prod.	7	2.2	2.2	494.9
Western hemlock	M high	130	TimberWest	6	8.3	7.2	1,464.6
Western hemlock	M high	196	MOF - Saanich	8	6.3	4.5	1,026.0
Western hemlock	M low	133	Canadian Forest Prod.	13	8.1	4.0	650.2
Western hemlock	M low	170	Western Forest Prod.	13	0.7	0.7	120.2
Western hemlock	M low	182	TimberWest	14	3.3	1.9	353.1
Western larch	EK low	333	MOF - Vernon	12	42.6	45.6	4,045.4
Western larch	NE low	332	MOF - Vernon	29	54.0	62.7	5,142.0
Western white pine	KQ	335	MOF - Vernon	2	37.0	7.8	143.4
Western white pine	KQ	609	MOF - Skimikin		68.6	19.4	272.3
Western white pine	M/SM	174	Canadian Forest Prod.		40.0	25.3	310.1
Western white pine	M/SM	175	MOF - Saanich		35.6	19.3	385.3
Western white pine	M/SM	403	TimberWest		11.0	4.4	70.9
Western white pine	M/SM	403	TimberWest		6.0	3.3	54.5

Forest Genetics Council of BC

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